

REMARKS

Claims 1, 6, 13, 17, and 21 have been amended. Claims 1-33 are pending in the application. Applicant respectfully requests entry of the above amendments, and reconsideration and allowance of the claims in view of the amendments and the following remarks.

1. Allowable Subject Matter

Applicant wishes to thank the Examiner for indicating allowable subject matter in the application. The Examiner indicated that claims 23-27 and 33 are allowed (See Office Action Summary dated December 18, 2003). The Examiner also indicated that claims 6-9, 13-16, 18 and 21-22 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims (See page 4 of Office Action dated December 18, 2003).

Because Applicant has amended independent claims 1 and 17, and because in view of these amendments and the below remarks Applicant believes claims 1 and 17 are now allowable, Applicant has not amended claims 6, 13, 18, and 21 in independent form, at this time. In view of the amendments to the claims, and the below remarks, Applicant respectfully requests withdrawal of the objections, rejections and allowance of claims 1-33.

2. Rejections Under 35 U.S.C. § 102(b)

The Examiner rejected claims 1-5, 10-12, 17, and 19-20 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,808,735 to Lee et al. Applicant respectfully disagrees for the following reasons.

Claim 1 recites a method of characterizing a sample surface having a surface anomaly region (e.g., dishing and/or erosion of a semiconductor surface). The method includes profiling the sample surface to generate surface characteristic data that includes data indicative of surface depth, generating a histogram of a number of occurrences of a surface depth based on said profiling step and measuring a surface anomaly in the surface anomaly region based on said generating step. Notably, “profiling,” *by definition*, is a measure of surface height over at least some portion of the sample. This measurement typically is obtained using a probe that is placed in mechanical contact with the sample surface. Lee et al. do not teach either a profiling step, or generating a histogram of surface depths resulting from the profiling step.

The Lee et al. patent is directed to an improved optical error-threshold optimization method of detecting and characterizing defects in a test surface of a semiconductor wafer (col. 13, lines 25-30). According to the method, each of a reference surface and a test surface is imaged and described having a unique x-y coordinate, a z coordinate, and an intensity value (col. 3, lines 20-25), and then the test and reference images are compared.

The images are obtained using confocal optics 50 (col. 4, lines 44-50). Preferably, a laser-based confocal microscope is used to pass a beam of light through an objective lens and scanned across a surface from different locations along the z-axis (col. 4, lines 58-61). A group of signals provided by an x-y coordinate scan from a single z-axis location of the objective lens is called a “slice,” and the slices are overlapped to

create a volumetric data set (col. 4, line 66 – col. 5, line 2). The slices are used to determine surface arrays SI and SZ representing x-y coordinates of maximum light intensity and x-y coordinates of respective z coordinates of the respective maximum intensity (col. 5, lines 9-17). The point of maximum light intensity gives an indication of the location of the surface contour represented by z-coordinates (col. 5, lines 29-31). Pixel pairs P_T, P_R of any aligned test pixel pair and reference pixel pair, respectively, assigned to an x-y location, that have pixel intensity values that differ by an amount exceeding a threshold are identified as potential defect pixels (col. 13, lines 25-30, *emphasis added*)

Based on the intensity of the reflected light, a defect area can be identified. More particularly, to do so, a pixel-by-pixel comparison between the test and reference images is made and the intensity difference is compared to a threshold.

The Lee et al. patent does not describe a method to identify and characterize a surface anomaly that includes generating a histogram of surface depth based generally solely on data generated by employing a profiling step. Lee et al. do not measure surface depth, they are trying to discern defect area and shape, and do so by making *a comparison between the test image and the reference image*. More particularly, Lee et al. describe a method to identify defects based on a histogram of a number of maximum pixel *intensity* values for each of sixty-four slices of data intensity data obtained by optical scanning with confocal optics (col. 11, line 60 – col. 12, line 4).

As a result, Lee et al. do not teach the step of generating a histogram based generally only on a number of occurrences of one or more surface depths (i.e., “profiling”) to identify and characterize a surface anomaly, as recited in claim 1.

Therefore, Lee et al. does not anticipate independent claim 1 and claims 2-5, 10-12, 28-31 and 33 dependent therefrom. Applicant respectfully requests an indication to

that effect. Furthermore, claims 2-5, 10-12, 28-31, and 33 may contain additional patentable subject matter not described herein.

Independent claim 17 recites a method that measures dishing values and erosion values associated with topography data generated by scanning a surface to obtain surface profile data. The method includes the steps of generating a histogram of a number occurrences of a surface depth associated with a portion of the surface profile data corresponding to a first zone of interest, and smoothing the histogram of said generating step to produce a smoothed curve having a peak corresponding to one of a dishing value and an erosion value.

As described above, Lee et al. do not disclose a method of measuring dishing values and erosion associated with topography data that includes “profiling” the surface, and generating a histogram based generally only on a number of occurrences of a surface depth associated with a portion of the surface profile. Therefore, independent claim 17 and claims 19-20 and 32 dependent therefrom, are not anticipated by Lee et al. Applicant respectfully requests an indication to that effect.

3. Rejections Under 35 U.S.C. § 103(a)

The Examiner rejected claims 28-32 under 35 U.S.C. § 103(a) as being unpatentable over Lee et al. in view of the “Atomic Force Microscope” reference to Baselt. Applicant respectfully disagrees for the following reasons.

Claim 28 (dependent from amended claim 1) clarifies that the profiling step is performed using a probe-based instrument movable in a direction generally perpendicular to the sample surface. Moreover, claim 29 (dependent from claim 28) defines the probe-based instrument as an atomic force microscope. In addition, claim 30 (dependent from

amended claim 1) highlights that the profiling step is performed using a probe-based instrument and that the surface characteristic data “is indicative of a three-dimensional image.” Finally, claim 31 (dependent from claim 30) defines the probe-based instrument as an “atomic force microscope.” It is this data acquired in the profiling step that is used in generating a histogram. The step of measuring a surface anomaly in the surface anomaly region is performed using the histogram.

Lee et al. suffers from the drawbacks discussed above with respect to the 102(b) rejections. Most generally, Lee et al. do teach obtaining raw surface height data to identify surface anomalies. Notwithstanding that Lee et al. teach a completely optical technique, their image of the test surface must be further processed (i.e., compared to the reference data) to identify a defect, directly contrary to the present preferred embodiments which identify surface anomalies based generally solely on the data obtained by the profiling step, i.e., no comparison, with reference data or otherwise, is performed or required. Notably, Applicant has amended independent claim 1 to clarify this aspect of the invention.

Moreover, the Baselt reference merely describes the general theory of atomic scope microscopy in generating an image of surface topography. The Baselt reference does not describe generating a histogram representative of the number of occurrences of a surface elevation to identify and characterize a surface anomaly.

The Examiner mistakenly attempts to combine the Baselt reference with Lee et al. to reject claims 28-32. At best, were the Baselt reference to be combined with Lee et al., the logical approach would be to also include an optical scanning means to detect a pixel intensity associated with an x-y location of a surface and to generate a histogram of maximum pixel intensities from a preferred sixty-four optical scans performed, in direct contravention to the “profiling” and “generating a histogram” (based generally only on

the corresponding surface heights) steps of the claimed invention. To do otherwise would be to pick and choose amongst the teachings of the prior art, using the Applicant's own disclosure as a template to latch on to those teachings that support the Examiner's position while ignoring those that do not. The Federal Circuit has held that a rejection based on obviousness cannot be predicated upon such an approach:

It is impermissible within the framework of section 103 to pick and chose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art.

In re Hedges, 228 USPQ 685, 687 (Fed. Cir. 1986), citing *In re Wesslau*, 3147 USPQ 391, 393 (CCPA 1965); see also MPEP §2143.01

For the above reasons, claims 28-32, as well as claims 1-22, are believed to patentably define over the cited combination of Lee et al. and the Baselt reference. A review of the remaining references of record similarly leads Applicant to conclude that the cited art fails to teach or suggest the patentable subject matter of claims 28-32, as well as claims 1-22. Therefore, claims 1-22 and 28-32 are believed to be novel and non-obvious over the cited art, and thus allowable.

CONCLUSION

In view of the above amendments and remarks, claims 1-33 are in compliance with 35 U.S.C. §§ 102, 103 and 112. An indication to this effect is respectfully requested.

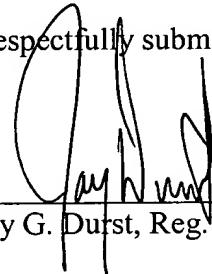
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Applicant respectfully requests a one-month extension of time under 37 CFR § 1.136 (a)(1) to respond to the December 18, 2003, Office Action. A check in the amount of **\$110.00** is included with this paper for the 1-month extension fee.

If any other fees are believed to be payable in conjunction with this or any future communication, authorization is given to direct payment of such fees, or credit any overpayment to Deposit Account No. 50-1170.

Should the Examiner have any questions, or wish to discuss any issue further to expedite the completion of the prosecution of this case, the Examiner is invited to contact the undersigned at the below number.

Respectfully submitted,


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